REMARKS/ARGUMENTS

Claims 30-33 are presently pending in this application. Claims 1-29 have been canceled.

All claims were rejected for obviousness with Buckner (3,751,377) as the primary reference and Klingebiel (3,941,529) and Muirhead (3,372,215) as secondary references.

Buckner was viewed as teaching the "basic claimed process", although the Office Action recognizes that Buckner does not teach intensive shearing during the dispensing step and less shearing in a second static mixer during the retaining step. Muirhead was relied upon as teaching to granulate the thermoplastic material by extruding and cutting the material into small particles.

The present invention, as defined by independent claim 30, requires, amongst others, a first static mixer which subjects the mixture to intensive shearing during the dispersing step and a second static mixer which subjects the mixture to less intensive shearing than in the first static mixer during the retaining step. Since Buckner is silent concerning relative shearing intensities, the rejection of claim 30 relies on Klingebiel as teaching "an intensive shearing portion followed by a lower shearing portion". In particular, Klingebiel was viewed as teaching "intense shearing during dispensing of the blowing agent in the molten thermoplastic resin stream (zones I-IV) in order to disperse said blowing agent throughout said molten thermoplastic (first mixer) ... [and] a lower shearing in order to randomize said dispersion throughout said molten thermoplastic melt (zones V-VI) (second mixer) (see col. 3, line 34 through col. 4, line 2)". This is not what Klingebiel discloses.

In column 3, lines 34-64, Klingebiel describes the six separate mixing zones or regions as follows:

- a first <u>low shear</u> mixing zone where the blowing agent is injected
- a second zone of <u>high shear</u> forming a finer dispersion
- a third zone of <u>unspecified shear intensity</u>

- a fourth zone of <u>intense shear</u>
- a fifth zone of <u>low shear</u>
- a sixth zone of <u>high shear</u>

In column 3, line 65 to line 4, line 2, Klingebiel states that the passage of the mixture through the last two zones of low shear and high shear prevents a coalescence of the dispersion mass. These two zones are zones V and VI ("the last two zones"), which are preceded by alternating zones of low and high shear. The last two zones are not equivalent to subjecting the mixture to intensive shearing at the first static mixer during the dispersing step and to a lesser shearing during the retaining step as recited in claim 30. By the time the mixture of Klingebiel reaches zone V (a low pressure zone), the blowing agent has long been injected and dispersed in the plastic melt. Moreover, the low/high shear intensity in zones V and VI of Klingebiel are the opposite of the high/low shear intensity sequence recited in claim 30.

As the foregoing demonstrates, throughout Klingebiel's process the mixture is subjected to alternating low and high intensity shearing. In contrast thereto, claim 30 requires high intensity shearing during the initial dispersing step and low intensity shearing during the following retaining step, the precise opposite of the sequence of shear intensities taught by Klingebiel. In addition, Klingebiel does not even mention static mixers, to which claim 30 is limited.

The Muirhead patent was relied upon in the rejection of claim 30 as teaching a process of forming expandable thermoplastic particles by extrusion followed by cooling and cutting the mixture into particles. Like Klingebiel, Muirhead nowhere mentions static mixers.

Claim 30 was held obvious over Buckner in view of Klingebiel and Muirhead because one of ordinary skill in the art would consider it obvious to combine Klingebiel's teaching to generate intense shearing while the blowing agent is injected into the thermoplastic resin in zones I-IV followed by subjecting the mixture to lower shearing in zones V-VI.

Klingebiel does not teach to one of ordinary skill in the art to modify the Buckner process by subjecting the melt to high shear followed by low shear, as recited in claim 30. Klingebiel teaches the exact opposite, namely a series of two-step shearing variations where low shearing is followed by high shearing. As pointed out above, zones I and V are low shearing zones and zones II, IV and VI are high shearing zones, while the shearing intensity in zone III is not specified. Applicant particularly disagrees with the statement in the Office Action that low shearing occurs in zones V-VI. Quite to the contrary, Klingebiel discloses (col. 3, lines 57-64):

> This results in the production of a very intimate dispersion which may then be randomized and redirected in flow in a succeeding *fifth low shear mixing zone* (similar to the pre-mixing region discussed hereinabove). The intimately dispersed mass is then forced through a *sixth mixing zone of high mechanical shear* (which may again comprise the performations or aperture means of a rotating perforated spinning disc). (italics added)

The same observation applies to the shearing intensities in zones I-IV. Klingebiel does not teach that these zones are high intensity shearing zones. To the contrary, Klingebiel discloses (col. 3, lines 35-49):

> Gross premixing is first effected in a *first low shear mixing zone* .... A second zone of *high mechanical shear* is provided (which may comprise the perforations or aperture means of a perforated spinning disc) .... The third mixing zone provided is a mixing region characterized by viscoelastic secondary flow patterns which direct the dispersion mass toward *a region of intense shear gradients*. The *fourth mixing zone of intense shear gradient* causes the characteristic relaxation rate .... (italics added)

Thus, Klingebiel does not teach that zones I-IV are high shear zones. It teaches that zone I is a low shearing zone, zones II and IV are high shearing zones, while the shearing intensity in zone III is not identified.

Accordingly, Buckner in combination with Klingebiel does not disclose or in any form suggest the steps of "providing a first static mixer in which the dispersing step is carried out and which subjects the mixture to *intensive shearing*; and providing a second static mixer in

which the retaining step is carried out and which subjects the mixture to *less intensive shearing* than in the first static mixer" (italics added). The references, including Muirhead (which does not even mention shearing), do not suggest the above-recited limitations of claim 30. As a result, claim 30 is not obvious over the references.

In this context, applicant points out that both secondary references (Klingebiel and Muirhead) are not even concerned with static mixers. As a result, one of ordinary skill in the art would not consider Klingebiel (or Muirhead) to be properly combinable because of basic process differences between systems employing dynamic mixers (e.g. extruders or rotating, perforated plates, as in Klingebiel) and systems employing static mixers and the resulting uncertainty whether process modifications in one system (e.g. a system employing dynamic mixers) would lead to the same results in the other system employing static mixers.

Still further, although Klingebiel discloses to alternate low and high intensity shear zones, it never discloses or in any form suggests to employ a high intensity shear zone during the injection of the blowing agent and a low intensity shear zone thereafter. Klingebiel discloses the exact opposite, as was demonstrated above. It would amount to an impermissible hindsight reconstruction of the prior art to selectively and out of order use a high shear zone, e.g. zone IV, followed by a low shear zone, e.g. zone V of Klingebiel, because neither Klingebiel nor any other reference of record suggests such a process. That process is disclosed in the present application alone, and its incorporation in claim 30 renders the claim patentably distinct over the references, including Klingebiel.

Independent claim 30, and claims 31 and 32 which depend from claim 30, were rejected over Buckner, Klingebiel, Muirhead and Cha for obviousness.

The first three references were applied in the same manner as they were applied against claim 30. The fourth reference, Cha (5,158,986), is limited to providing first and second, serially arranged static mixers, with the first mixer having a relatively smaller cross-sectional flow-through area than the second mixer, together with "flowing the mixture serially through the first and second mixers … [subjecting] the mixture to relatively high intensity shearing as the

mixture flows through the first static mixer and ... to relatively less intense shearing as the mixture flows through the second static mixer ...."

Independent claim 33, as well as claims 31 and 32, differ from claim 30 in that they recite the cross-sectional through-flow areas of the two mixers which lead to high and low intensity shearing, respectively, in the first and second mixers. Applicant does not dispute that one of ordinary skill in the art recognizes that for static mixers of a given flow a high shear zone requires a lesser cross-sectional flow-through area than a low shear zone. However, none of the references, including in particular Cha, discloses or in any form suggests the serial arrangement of a first high shear mixer during the injection of the blowing agent followed by a second low shear mixer, as is recited in the second-to-last paragraph of claim 33. This difference in the recited flow-through areas of the first and second mixers results from the differences in the cross-sectional areas of the mixer recited in the third paragraph of claim 33. For the reasons discussed at length above why claim 30 is not obvious over Buckner, Klingebiel and Muirhead, claim 33, together with dependent claims 31 and 32, are not obvious over these references when further combined with Cha.

CONCLUSION

In view of the foregoing, applicant submits that this application is now in condition for allowance and requests a formal notification to that effect at an early date.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,

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